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(54) Vibration damping handle

(57) A vibration-damping handle which comprises a first vibration-damping body (1) adapted to be connected to a vibration source such as a motorcycle or a motor driven hand tool, a second vibration-damping body (4) being mounted on the first vibration-damping body by a first connecting member (3) and a third vibration-damping body (7) adjacent the first vibration-damping body but connected to the second vibration-damping body via a second connecting member (6) which constitutes a hand-grip. An elastic coupling (8) is provided between the first and third vibration-damping bodies, and the second connecting member is of a material having less rigidity than that of the first connecting member, whereby the second vibration-damping body is vibrated by a cantilever effect from the first vibration-damping body, and any hazardous vibration which may cause physical injury, such as a white finger disease, is substantially damped out by the handle's operational behaviour.

FIG . 1

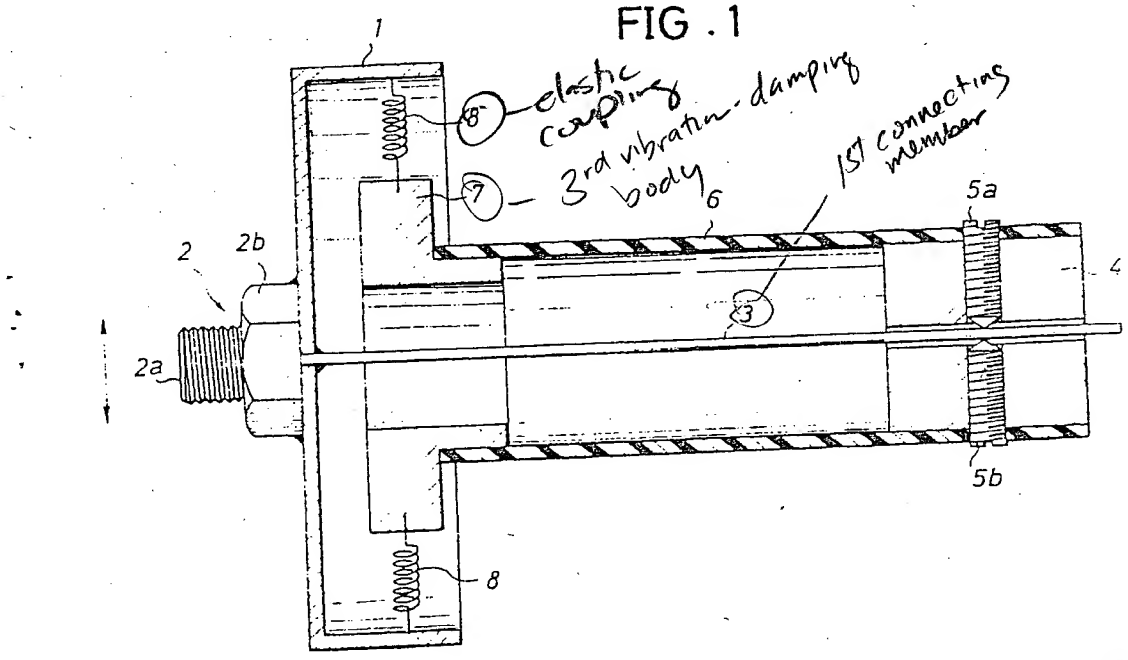


FIG. 1

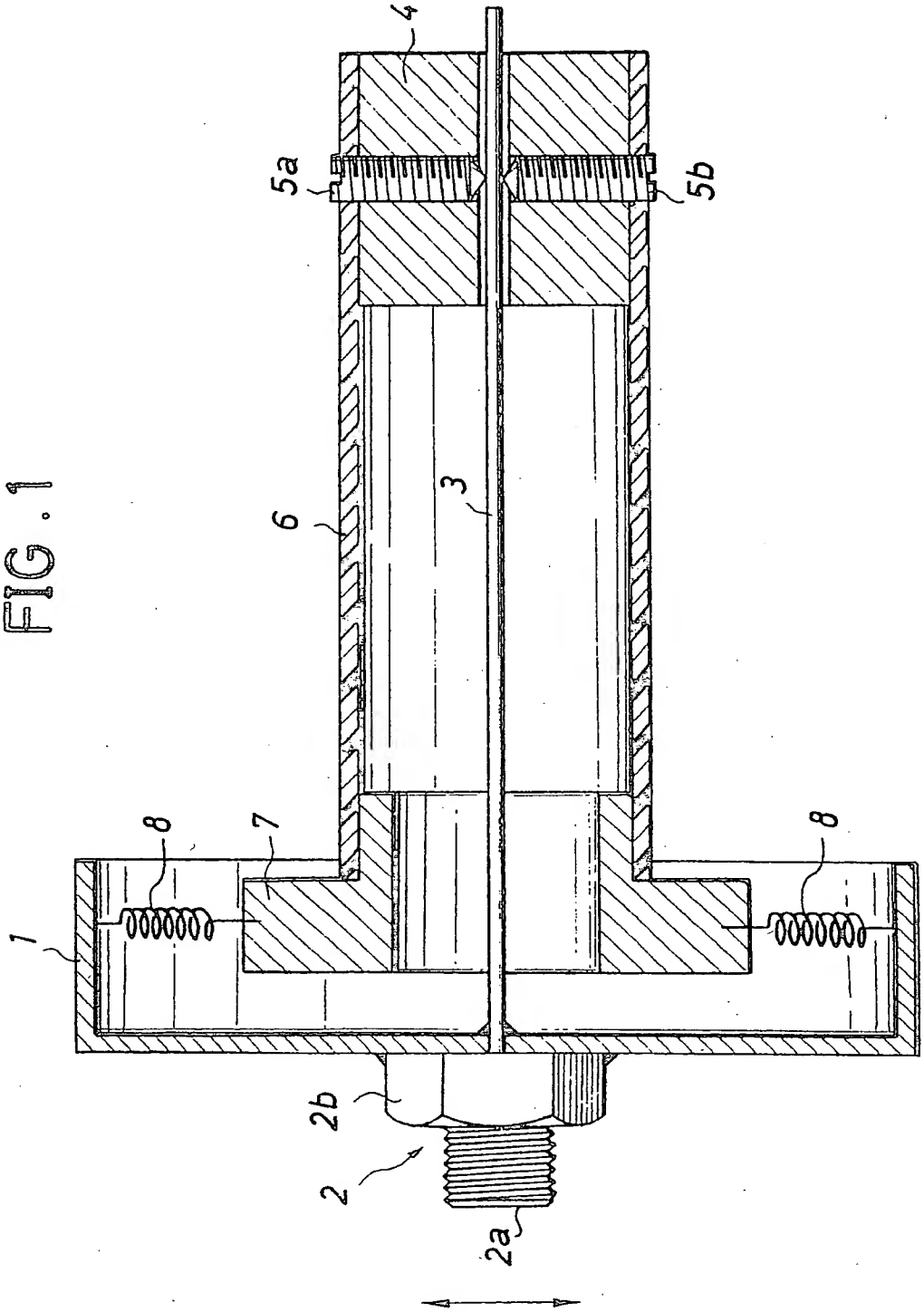


FIG. 2

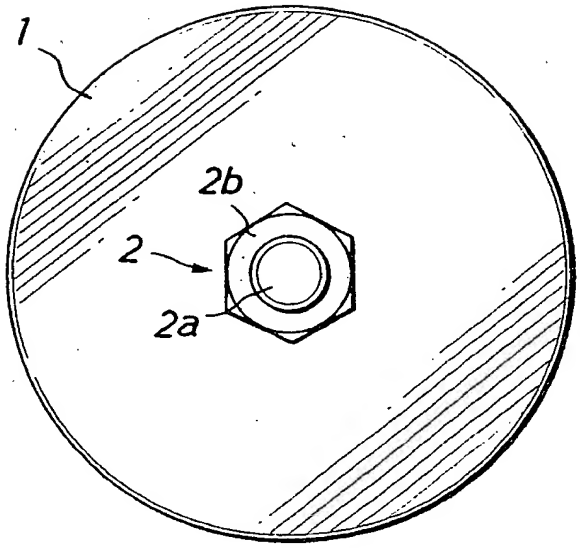
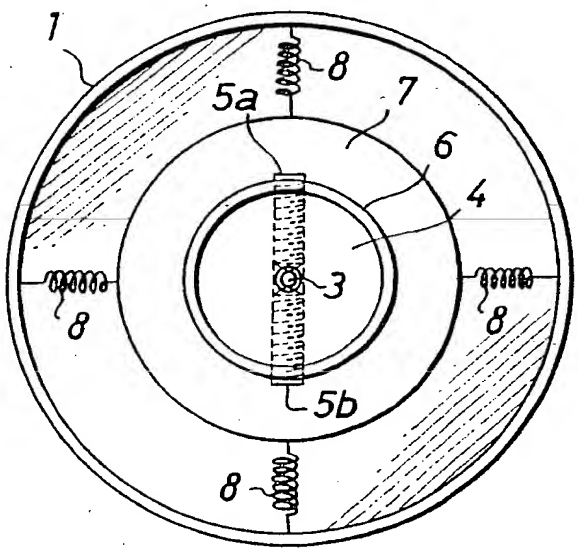


FIG. 3



SPECIFICATION
Vibration damping handle

The present invention relates to vibration-damping handles for use in controlling electro-mechanical or pneumatic tools, or other machines producing vibrations when operating, such as motor-cycles.

An elastic material is frequently used as a vibration damper. However, if a material has sufficient elasticity to give an adequate damping effect, the control provided by handle operation is then so flexible or soft that it becomes difficult to ensure stability in operation. For instance, in the case of motorcycles, it brings about an adverse effect in the stability of any steering operation, and in the case of electro-mechanical tools centering becomes difficult a wobbling or staggering is likely to occur.

If a vigorous vibration is transmitted to a hand-grip of a vibrating tool or other machine, physical damage may result, such as white finger disease. It is therefore important to damp such hazardous vibrations to preserve the health of workers who operate such vibration tools or machines.

One object of the present invention is to provide a vibration-damping handle which is capable of effectively damping hazardous vibrations whilst rigidly supporting a hand-grip to facilitate positive control.

The present invention consists in a vibration-damping handle for use with a source of vibration, said handle comprising a first vibration-damping body for connection to a vibration source, a second vibration-damping body supported on a first connecting member extending in the form of a tie-rod from the centre of the first vibration-damping body and normal to the adjacent surface thereof, a third vibration-damping body disposed adjacent the first vibration-damping body and surrounding but well-spaced from said first connecting member, a second connecting member connecting the second and third vibration-damping bodies to form a hand-grip, and an elastic coupling between the first and third vibration-damping bodies, said second connecting member having less rigidity than said first connecting member, whereby said second vibration-damping body is vibrated by its cantilever mounting from the first vibration-damping body, when operating.

The term "vibration-damping body" is used here to refer to a body whose mass is of sufficient magnitude to significantly affect the vibrational characteristics of an assembled handle.

The invention will now be described with reference to the drawings, in which:—

Figure 1 is a simplified schematic cross-sectional side view of one exemplary embodiment of a handle constructed in accordance with the present invention;

Figure 2 is an end view showing the handle as viewed from the left; and

Figure 3 is an end view showing the handle as viewed from the right of figure 1.

A vibration source (not shown), such as a tool or machine is connected to a handle comprising a vibration-damping body 1 which itself constitutes a significant mass forming a first vibration-damping body, and is in the shape of a circular hollow dish, although other shapes may be used, so long as the body is substantially rigid and has a sufficient mass for the required damping effect. Further, although this body has rotational symmetry in the illustrated embodiment, this is not an essential requirement.

A connecting means 2 is firmly secured to the centre of the outer end face of the vibration receiving member 1, being adapted for connection to the vibration source (not shown), e.g. to the frame assembly of a motorcycle. The handle shown is for use as a hand-grip of the motorcycle, so that there will be a pair of such handles attached one at each side of the motorcycle frame assembly. In the case of an electro-mechanical tool such as a grinder, drill or a hacksaw, the handle may be attached to the casing or housing thereof. This connecting means 2 is included in the mass of the first vibration-damping body, and as can be seen by comparison of figures 1 and 2, the connection is composed of a threaded bolt 2*a* having its inner end welded to the vibration receiving member 1, and a nut 2*b* screwed down the bolt and also welded to the face of the member 1. The connecting means 2 may be formed as an integral part of the vibration receiving member 1, e.g. by milling. A female screw thread may be provided as a secure fastening means for connection to the vibration source, and instead of a screw type connection, a rivetted or welded connection may be used.

A tie-rod 3 having a length of from 10 to 20 cm in this embodiment, has one end firmly secured to the vibration receiving member 1, and extends normal to the surface from the centre of the vibration receiving member towards the right in figure 1, to constitute a first connecting member. In the case of a hand-grip for a motorcycle, the diameter of the tie-rod 3 is about 4 to 8 mm. The tie-rod 3 may be made of a piano wire, and has a circular cross-section in the illustrated embodiment, although, its cross-section may be angular or of any other required form.

A second vibration-damping body 4 is secured to the free end of the tie-rod 3 by one or more threaded pins, in this case two pins 5*a* and 5*b*, although three or more may be provided to assist in centering the second body on the tie-rod. Alternative means for adjusting the body 4 on the tie-rod 3 may be used, for example a threaded bore in the body 4 could be screwed on to a thread on the tie-rod, and a lock nut provided for setting. In some cases the body 4 may be fixed to the tie-rod.

A third vibration-damping body 7 is disposed concentrically within the vibration receiving member 1 and about the tie-rod 3. A sleeve 6 made of a flexible material having a slight elasticity, such as a synthetic resin or hard paper constitutes a second connecting member, being

secured at its left end to the second vibration-damping body 7, by a fastening means such as an adhesive, or by screws, and secured at its right end to the third vibration-damping body 4. The sleeve 6 is disposed concentrically with respect to the tie-rod 3 which passes through the centre of the sleeve 6 well spaced from the sleeve. The sleeve 6 constitutes a tubular hand-grip.

A plurality of radially extending springs 8 are provided between the vibration receiving member 1 and the third vibration-damping body 7, and are equi-spaced around the centre, as can be seen in Figure 3. The springs 8 may be replaced by a single rubber diaphragm or the like. These springs 8 constitute a spring coupling for the handle and also contribute to the vibration-damping effect in many cases.

In view of the vibrations anticipated during operation, all fixing elements will normally incorporate locking or shake-proof securing means, which have not been illustrated for the sake of clarity.

The damping operation of the handle will now be described.

A vibration transmitted to a hand-grip from a vibration source such as a motorcycle, or the housing of an electro-mechanical tool, if continued for a long period of time, may cause a so-called white finger disease, thus leading to a serious health problem for the operator. The vibration-damping handle is intended to effectively, if not completely, damp any such hazardous vibration, and thereby to substantially eliminate such a health risk, and reduce operator fatigue.

The vibration is directly transmitted via the connecting means 2 to the vibration receiving member 1 with substantially the same amplitude and frequency as is produced by the vibration source, and it will then be transmitted via the tie-rod 3 to the second vibration-damping body 4. If the vibration receiving member 1, which itself acts as a first vibration damping body, is assumed to be static, the second body 4 vibrates transversely via the tie-rod 3 as this is an elastic member. The vibration will then be transmitted to the third vibration-damping body 7 via the sleeve 6. Experiment has shown that this body 7 has a vibration phase approximately inverse to the vibration phase of the vibration-damping body formed by the member 1, and is substantially balanced by the other components to cancel out the hand-grip vibration, whereby the vibration transmitted to the hands of an operator holding the sleeve 6 serving as a hand-grip may be reduced to as little as 1/10 to 1/20 of the original vibration, which would otherwise be directly transmitted to the hand-grip. It will also be seen that the sleeve 6, which is made of a slightly elastic material, also serves to damp the vibration in a manner similar to rubber, and further the radially disposed springs 8 present a similar effect. Namely, it is believed that the second and third vibration-damping bodies 4 and 7 perform vibration movements to cancel out the vibration of the vibration receiving member 1 which acts as the first vibration-damping body, whereby the initial vibration energy is dispersed by the vibration-damping means which absorb the energy. Further, in the handle the first connecting member and the second connecting member are made of reasonably rigid material, and the second connecting member itself constitutes a hand-grip, so that there is no danger that the operational control provided is too flexible or too soft.

Other embodiments of vibration damping handles are described in our co-pending (United Kingdom Patent Applications No. 8 119 221 (V734); No. 8 119 222 (V750); and No. 8 119 224 (V751); all of even date.

CLAIMS

1. A vibration-damping handle for use with a source of vibration, said handle comprising a first vibration-damping body for connection to a vibration source, a second vibration-damping body supported on a first connecting member extending in the form of a tie-rod from the centre of the first vibration-damping body and normal to the adjacent surface thereof, a third vibration-damping body disposed adjacent the first vibration-damping body and surrounding but well-spaced from said first connecting member, a second connecting member connecting the second and third vibration damping bodies to form a hand-grip, and an elastic coupling between the first and third vibration-damping bodies, said second connecting member having less rigidity than said first connecting member, whereby said second vibration-damping body is vibrated by its cantilever mounting from the first vibration-damping body, when operating.

2. A handle as claimed in claim 1, in which said second connecting member is a tubular hand-grip with the first connecting member passing through but well spaced therefrom.

3. A handle as claimed in claim 1 or claim 2, in which said first connecting member is a rod having a diameter of from 4 to 8 mm.

4. A handle as claimed in any preceding claim, in which said elastic coupling is a rubber diaphragm.

5. A handle as claimed in any one of claims 1 to 3, in which said elastic coupling is in the form of a plurality of radially extending springs between said first and third vibration-damping bodies equi-spaced around their centre.

6. A handle as claimed in any preceding claim, in which said first vibration-damping body is of rotationally symmetrical cup-shaped form.

7. A vibration-damping handle substantially as described with reference to Figures 1 to 3.

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